

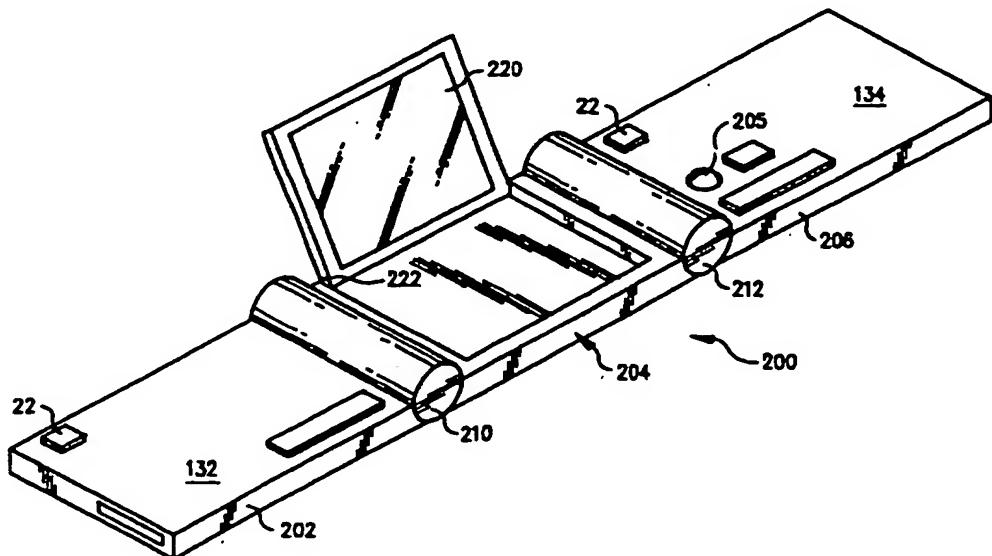
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(54) Title: COMPUTER KEYBOARD AND METHOD FOR CONFIGURING SAME



(57) Abstract

A computer keyboard (120) and method for configuring same. The computer keyboard is separated into at least two separate subarrays of keys (124 and 126). Within each subarray of keys, the keys are arranged in parallel rows. A subarray of keys can also include other devices for controlling cursors and other indicators. When the keyboard of the present invention is arranged for use by a user, the two subarrays are arranged so that the rows in the two subarrays are parallel to each other and an interaction area (204) is placed between the two subarrays. In some embodiments the interaction area can include a display (220) and/or additional keys or devices for interaction with the user, for example, a cursor controller or voice-activated device.

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Description**COMPUTER KEYBOARD AND METHOD FOR CONFIGURING SAME**5 Technical Field

The present invention relates to a computer keyboard, and more particularly, to a computer keyboard that is configured for ergonomic operation and a method for configuring the same.

10 Background of the Invention

Computers, and especially personal computers, have become a part of present-day life for many persons. It is very common for a person to use a keyboard to enter information and control a computer, often for prolonged continuous periods of time. 15 However, the keyboard has not developed as rapidly as the computers with which they are used. Although most present-day keyboards are electronic, for the most part, their layout is basically the same as the typewriter keyboards from which they derived. Unfortunately, the way a standard keyboard is laid out 20 causes muscle fatigue and may result in injury to the user.

There has been some development of keyboards that are ergonomically developed for prolonged use; however, they are still relatively uncommon. Probably the foremost specialized keyboard offered at present is the "Natural Keyboard" that is 25 marketed by Microsoft Corporation as an ergonomically efficient keyboard. Another specialized keyboard is the GlidePoint Wave Keyboard, which is, for example, sold by Egghead, of Liberty Lake, Washington.

The keys for entry of letters, numbers and punctuation are 30 placed in two separate groups, each intended primarily for operation by a particular one of a user's two hands. In the QWERTY keyboard configuration, for example, the two groups are separated by an imaginary boundary drawn between the "6" and "7" keys in the first row, between the "T" and "Y" keys in the 35 second row, between the "G" and "H" keys in the third row, and between the "B" and "N" keys in the fourth row.

In the standard parallel row keyboard, the two groups of keys are separated by a distance that is smaller than the

typical width of a user's body, just as are the keys in a standard keyboard. Therefore, the user's two arms are angled inward toward the keyboard.

In the Microsoft keyboard, the rows of keys in each of the two groups of keys are parallel, but the rows of keys in one group are not parallel to the rows of keys in the other group. Rather, the rows of keys in the two groups of keys are angled away from one another, so that the user's hands are closer than the width of the user's body. When the two groups of keys are placed together, as in the typical keyboard, the imaginary boundary between the groups of keys is generally aligned perpendicular to the user's body and passing through any monitor that may be used with the keyboard.

There are other items associated with a computer keyboard that have commonly become part of the operation of a computer. For example, a separate numeric keypad is typically available for operation by a particular hand (usually the right hand). Such numeric keypads are very useful for efficient entry of numbers and relevant other operations, such as the four arithmetic operations of addition, subtraction, multiplication and division and entry of a decimal point. Some keyboards use a subset of the keys in one of the two groups of keys as a keypad, most commonly for operation by the right hand. In this configuration, this special subset of keys is activated by a special function key that changes the character of the affected keys and disables the operation of the other keys in that group. More often, however, a keypad (which is continuously activated) is placed away from the two groups of keys. The keypad is generally placed to the right side of the two groups of keys, probably because most users are right-handed. When there are additional keys such as those described above, a standard configuration keyboard is placed asymmetrically to the right relative to the imaginary line discussed above.

Aside from the keypad, other keys that are often available for controlling a cursor on the computer display include left, right, up, down, home and end keys control, as well as Num Lock and Scroll Lock keys.

In the standard keyboard configuration, where the two groups of keys are placed together, the user's forearms are

positioned diagonally toward the imaginary line, forming an angle in relation to the center line of the keyboard. At the same time, the user's hand have to rotate to allow the fingers on each hand to be placed on the corresponding keys. As a 5 result, the positioning and operation of the keyboard is unnatural and creates muscle tensions on the wrists and forearms. These tensions, in turn, cause fatigue and possible injury to the arms and hands after prolonged use of the keyboard.

10 In all keyboards of which the inventor is aware, most of the keys are intended for operation by the user's right hand. The imbalance of this load causes the right hand to be overloaded and operation efficiency is diminished. Regardless, in the standard use of a keyboard, the transverse span of 15 distance between the keyboard and a cursor control (such as a mouse) is asymmetrically placed relative to the user's body. For example, in the most common situation, where a keyboard and mouse is used by a right-handed user, the center of the distance between the left-hand edge of the keyboard and the right-hand 20 edge of the mouse is asymmetrically placed to the right of the line between the user's body and the personal computer's display.

While most personal computers are desktop models, a significant fraction of the personal computers produced in 25 today's market have the form of portable computers, specifically laptop, notebook and palmtop computers. In addition, personal information managers, digital diaries and electronic data organizers, which are even smaller than such computers, include 30 small keyboards. Such computers (and other electronic devices with keyboards) are necessarily more compact than desktop computers. Accordingly, their keyboards, which are generally hinged to fold against a display device for storage, must be especially compact. Such keyboards are even more troublesome 35 than those described above for desktop computers keyboards, because they are smaller, often not more than 10 inches in width. This necessarily means that the keys in such keyboards are smaller and more closely spaced than those in desktop computer keyboards, hastening the difficulties described above in connection with desktop computer keyboards.

Other known keyboards are those described by Pollitt, in United States Patent No. 5,267,127, by Conway et al., in United States Patent No. 5,278,779, by Conway, in United States Patent No. 5,410,333, and by Chiu et al., in United States Patent No. 5,457,453. In addition, other known keyboards are those described by Lin et al., in United States Patent No. 5,490,036, by Clancy, in United States Patent No. 5,490,037, by Lookofsky, in United States Patent No. 5,416,730, and by Goodrich et al., in United States Patent No. 5,375,076. Still further known keyboards are those described by Konno et al., in United States Patent No. 5,278,725, by Ma, in United States Patent No. 5,255,214, by Yanagisawa, in United States Patent No. 5,126,725, and by Szmanda et al., in United States Patent No. 5,067,834. Even further known keyboards are those described by Miyazaki, in United States Patent No. 4,939,514, by Hsieh, in United States Patent No. 4,926,365, by Krenz, in United States Patent No. 4,903,221, by Carter et al., in United States Patent No. 4,903,222, and by Tatsuno, in United States Patent No. 4,870,604. However, none of these keyboards provides a key configuration which is suitable for desktop operation where the user's arms are parallel, and which can possibly be configured to be folded to a compact size.

Summary of the Invention

According to one aspect, the invention is a keyboard for two-handed use by a user. The keyboard includes a first array of keys, a second array of keys, and an interaction area. The first array of keys is intended for predominant use by a first hand of the user and includes a first set of substantially parallel rows of keys.

The second array of keys is intended for predominant use by a second hand of the user and includes a second set of substantially parallel rows of keys. The rows in the second set of rows of keys are substantially parallel to the rows in the first set of row of keys when the keyboard is arranged for use by the user.

The interaction area is intended for interaction with the user. The interaction area is located between the first and second arrays of keys when the keyboard is arranged for use by

the user.

According to another aspect, the invention is a keyboard for a system for preparation of arrays of symbols. The system is capable of displaying the arrays of symbols and includes a pointing device for controlling a cursor symbol in a displayed array of symbols. The pointing device is also for designating symbols in a displayed array of symbols. The keyboard is intended for two-handed use by a user and includes a first array of keys, a second array of keys, and a third array of keys.

10 The first array of keys is intended for predominant use by a first hand of the user and includes a first set of substantially parallel rows of keys. The second array of keys is intended for predominant use by a second hand of the user and includes a second set of substantially parallel rows of keys. 15 The rows in the second set of rows of keys are substantially parallel to the rows in the first set of row of keys when the keyboard is arranged for use by the user.

20 The third array of keys is located between the first and second arrays of keys and is intended for use by either of the first and second hands of the user. The third array of keys includes at least one control key for controlling the cursor in combination with the pointing device.

25 According to yet another aspect, the invention is a method for producing a keyboard for two-handed use by a user. The method includes the steps of a) producing a first array of keys, the first array of keys being intended for predominant use by a first hand of the user and including a first set of substantially parallel rows of keys and b) producing a second array of keys, the second array of keys being intended for predominant use by a second hand of the user and separated from the first array of keys and including a second set of substantially parallel rows of keys, the rows in the second set of rows of keys being substantially parallel to the rows in the first set of row of keys when the keyboard is arranged for use 30 by the user.

35 The method further includes the steps of c) producing an interaction area for interaction with the user, and d) locating the interaction area between the first and second arrays of keys when the keyboard is arranged for use by the user.

Brief Description of the Drawings

Figure 1 is a depiction of the layout of a conventional desktop keyboard known in the prior art.

5 Figure 2 is a depiction of the layout of a desktop keyboard in accordance with one aspect of the invention.

Figure 3 is a schematic diagram of one embodiment of the invention, showing the embodiment in a folded storage configuration.

10 Figure 4 is a schematic diagram of the one embodiment of the invention, showing the embodiment in a partially unfolded configuration.

Figure 5 is a schematic diagram of the one embodiment of the invention, showing the embodiment in a completely unfolded 15 usable configuration.

Figure 6 is a schematic diagram of another embodiment of the invention, showing the other embodiment in a folded storage configuration.

20 Figure 7 is a schematic diagram of the other embodiment of the invention, showing the other embodiment in a partially unfolded configuration.

Figure 8 is a schematic diagram of the other embodiment of the invention, showing the other embodiment in a completely unfolded usable configuration.

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Detailed Description of the Preferred Embodiment of the Invention

Figure 1 is a depiction of the layout of a conventional desktop keyboard known in the prior art. The keyboard 20 30 includes an array of keys 22 arranged in the form of four subarrays. A first subarray 24 is the left hand module, which is primarily intended for activation with fingers on a user's left hand. A second subarray 26 is the right hand module, which is primarily intended for activation with fingers on a user's right hand. A third subarray 28 is the keypad/cursor control module, which is also primarily intended for activation with fingers on a user's right hand. A fourth subarray 29 is the function module, which is intended for activation with fingers on both of a user's hands, although those keys on the left-hand side of the

fourth subarray 29 will be activated primarily by fingers on the user's left hand and those keys on the right-hand side of the fourth subarray 29 will be activated primarily by fingers on the user's right hand. In some applications, the fourth subarray 29 5 may not be necessary.

The keys 22 in the first subarray 24 include letter keys 22a, number and special character keys 22b. The letter keys 22a are typically the keys whose activation cause an indication of one of the letters included in the left hand portion of a 10 typical QWERTY keyboard to be placed on a display or transferred to some sort of recording medium such as an electronic memory, a magnetic medium or a piece of paper. Of course, other keyboard configurations beside the QWERTY keyboard (such as the Dvorak 15 keyboard) can be accommodated. The letter keys 22a can cause the transfer of an upper case letter or a corresponding lower case letter, depending upon the position of either of two separately-activated shift keys 22d. One of the shift keys 22d is included in the first subarray 24 and the other of the shift keys 22d is included in the second subarray 26. In addition, the number keys 20 22b can also cause the transfer of either a number or a second character, depending upon the position of either of two separately-activated shift keys 22d. Among the other keys 22 are the Tab key, the Cap Lock key, the Control (CTRL) key, the Alt key and (possibly) the Window (WIN) key. The Tab key causes a 25 cursor to move left and right in an array of indicated letters or characters to a predetermined place in the array. The Cap Lock key causes all letters to be capitalized. The Control and Alt keys perform special functions relating to operation that originated with teletype keyboards. The Window key is used in 30 applications using Microsoft Windows 95 to activate the basic Windows 95 menu.

It will be understood by those skilled in the relevant arts that aside from alphabetic characters, such as Roman, Greek, 35 Arabic, Hebraic or Cyrillic characters, the keys 22 can also be activated to produce ideographs such as the characters used in Chinese, Japanese, Korean and other ideograph-based written languages. Of course, other systems of characters can also be produced by keyboards of the sort described in the present patent application.

The keys 22 in the second subarray 26 include further letter and punctuation character keys 22e, and further number and special character keys 22f. The further letter and punctuation character keys 22e and further number and special character keys 22f are separated from the keys 22 in the first subarray 24 by an imaginary curved boundary 30. The letter keys 22e operate similarly to the letter keys 22a in the first subarray 24 and therefore their activation causes an indication of one of the letters included in the right hand portion of a typical QWERTY keyboard to be placed on a display or transferred to some sort of recording medium such as an electronic memory, a magnetic medium or a piece of paper. The letter keys 22a can cause the transfer of an upper case letter or a corresponding lower case letter, depending upon the position of either of two separately-activated shift keys 22d. In addition, the number keys 22b can also cause the transfer of either a number or a second character, depending upon the position of either of two separately-activated shift keys 22d. One key, the space key 22h, extends to both sides of the boundary 30. The keys 22 in the second subarray 26 also include the Backspace (←) key, the Enter key, the Control (CTRL) key, the Alt key, the Window (WIN) key, and the Print (PRT) key. The Backspace key causes the cursor to simultaneously erase the character to its left in an indicated array of characters and move to the left by one space. The Enter key sends end-of-line (EOL) and EOL and line feed indications to the display device showing the indicated array of characters. The Control and Alt keys perform special functions relating to operation that originated with teletype keyboards. The Window key is used in applications using Microsoft Windows 95 to activate the basic Windows 95 menu. The Print key causes a current page to be printed on a printer device that is connected to the personal computer system.

The keys 22 in the third subarray 28 include cursor direction keys 22n, 22s, 22l and 22r, text control keys 22t, and numeric keypad keys 22h. The keys 22 in the third subarray 28 are separated from the keys 22 in the second subarray 26 by the straight boundary 34. It will be noted that the keys 22 in the third subarray 28, which are used to control the cursor

direction and the text and which are used to enter large amounts of numeric information, are equally well suited for use by the user's left hand, except for their placement to the right of the second subarray 26.

5 The keys 22c in the fourth subarray 29 are used for the performance of special functions, usually related to features of the conventional personal computer (not shown) to which the keyboard is attached (or of which the keyboard is a part). A set of indicator lights 36 is located in an upper row 40 that
10 includes the fourth subarray 29 of function keys 22c and 22g and auxiliary keys 22k. The fourth subarray 29 is separated from the first, second, and third subarrays 24, 26 and 28, respectively, by a boundary 42. While the primary concern of the present
15 invention is the relative placement of the first, second and third subarrays 24, 26 and 28, the relative placement of the fourth subarray 29 is also considered to be part of the invention.

The keys 22 in the first subarray 24 are positioned for activation by fingers on the user's left hand, using the "F" key 22i as a home key for the user's left hand index finger. The keys 22 in the second and third subarrays 26 and 28 are positioned for activation by fingers on the user's right hand. When the user is entering text using the keys 22 in the second subarray 26, the user generally uses the "J" key 22j as a home key for the user's right hand index finger. When the user is entering numbers using the keys 22h in the keypad, the user generally uses the "5" key 22s as a home key for the user's right hand middle finger. Therefore, in the conventional prior art, the user's right hand is used to activate significantly more keys than the user's left hand is used to activate. The space key 22h is activated by either of a user's two hands.

Figure 2 is a depiction of the layout of a desktop keyboard in accordance with one aspect of the invention. The keyboard 120 includes an array of keys 122, also arranged in the form of four subarrays. A first subarray 124, which is substantially identical to the first subarray 24 shown in Figure 1, is also the left hand module in the keyboard 120. The first subarray 124 includes a space key 22h1 for entry of a space character. A second subarray 126, which is substantially identical to the

second subarray 26 is the right hand module in the keyboard 120. The second subarray 126 includes a space key 22hr for entry of a space character. A third subarray 128, which is substantially identical to the third subarray 28, is placed between the first and second subarrays 124 and 126. In this way the keys in the third subarray 128 are more conveniently activated by either the user's left hand or the user's right hand, since they are placed between the first and second subarrays 124 and 126.

The keys 22c and 22g in the fourth subarray 129 are substantially identical to the keys 22c and 22g in the fourth subarray 29. A set of indicator lights 136 is located in an upper row 140 that includes the fourth subarray 129 of function keys 22c and 22g and auxiliary keys 22k. The fourth subarray 129 is separated from the first, second, and third subarrays 124, 126 and 128, respectively, by a boundary 142. While the primary concern of the present invention is the relative placement of the first, second and third subarrays 124, 126 and 128, the relative placement of the fourth subarray 129 is also considered to be part of the invention. The functionality of any particular key 22 in the keyboard 120 is unchanged from the functionality of its counterpart in the keyboard 20.

The arrangement of the keys 22 in the keyboard 120 allows them to be separated along a straight boundary 130 which divides the keys 22 into a left hand array 132 and a right hand array 134. The keys in the left hand array 132 include the keys in the first array 124, and those keys in the third array 128 or the fourth subarray 129 which are also to the left of the boundary 130. The keys in the right hand array 134 include the keys in the second array 126, and those keys in the third array 128 or the fourth subarray 129 which are also to the right of the boundary 130. Accordingly, the keys in the keyboard 120 can be divided into the four separate subarrays 124, 126, 128 and 129 by separation along straight boundaries. Similarly, the keys in the left hand array 132 can be separated from the keys in the right hand array 134 (for example, by folding along the straight boundary 130) without disrupting the functionality of any of the keys 22. In the keyboard layout depicted in Figure 2, the boundary 130 is naturally placed close to the line between the user and the personal computer's display.

Figure 3 is a schematic diagram of one embodiment of the invention, showing the embodiment in a folded storage configuration. Figure 4 is a schematic diagram of the one embodiment of the invention, showing the embodiment in a partially unfolded configuration. Figure 5 is a schematic diagram of the one embodiment of the invention, showing the embodiment in a completely unfolded usable configuration. In this embodiment, a computer 200 includes a left hand portion 202, a middle portion 204, and a right hand portion 206. The left hand portion 202 is pivotally connected to the middle portion 204 through a vertical hinge 210 as will be understood by those skilled in the relevant arts. The middle portion 204 is pivotally connected to the right hand portion 206 through a vertical hinge 212 as will also be understood by those skilled in the relevant arts.

In a first version of this embodiment of the invention, the left hand portion 202 can be structured to include the keys in the left hand array 132 (see Figure 2) and the right hand portion 206 can be structured to include the keys in the right hand array 134 (see Figure 2). The middle portion 204 can be structured to include an interaction component 220, such as a display which can be folded upwardly from the remainder of the middle portion 204 about a horizontal hinge 222. The interaction component 220 can also be, for example, a touch-sensitive display, a touchpad, a cellular telephone, a microphone, and infrared (IR) port, and other components that would be understood by those skilled in the relevant arts. The remainder of the middle portion 204 can include further components for interaction between a user and the computer 200, such as a cursor control device 205 (for example, a trackball or a touchpad).

In a second version of this embodiment of the invention, the left hand portion 202 can be structured to include the keys in the first subarray 124 (see Figure 2) and the right hand portion 206 can be structured to include the keys in the second subarray 126 (see Figure 2). As above, in this second version of the embodiment, the middle portion 204 can be structured to include the display 220 and the remainder of the middle portion 204 can include the keys in the third subarray 128 (see Figure

2), in addition to other components for interaction between a user and the computer 220, such as a cursor control device 205 (for example, a trackball or a touchpad).

Figure 6 is a schematic diagram of another embodiment of the invention, showing the other embodiment in a folded storage configuration. Figure 7 is a schematic diagram of the other embodiment of the invention, showing the other embodiment in a partially unfolded configuration. Figure 8 is a schematic diagram of the other embodiment of the invention, showing the other embodiment in a completely unfolded usable configuration. The keyboard 300 is folded into a left portion 302 and a right portion 304. The left and right portions 302 and 304 are connected by a hinge 306. The left portion 302 includes a left keyboard portion 310 and a left display portion 312, which are connected by a left hinge 314. The right portion 304 includes a right keyboard portion 320 and a right display portion 322, which are connected by a right hinge 324.

The left keyboard portion 310 can include the left hand array 132 (see Figure 2) and the right keyboard portion 320 can include the right hand array 134 and a cursor control device 305. The left display portion 312 and the right display portion 322 can actually be made from an appropriately chosen display device, such as a display made from a single array of addressable diodes for the production of an image by patterns of light and dark and/or patterns of selected colors.

While the foregoing is a detailed description of the preferred embodiment of the invention, there are many alternative embodiments of the invention that would occur to those skilled in the art and which are within the scope of the present invention. Accordingly, the present invention is to be determined by the following claims.

The corresponding structures, materials, acts, and equivalents of all means or step plus function elements in the claims below are intended to include any structure, material, or acts for performing the functions in combination with other claimed elements as specifically claimed.

Claims

1. A keyboard for two-handed use by a user, comprising:
 - 5 a first array of keys intended for predominant use by a first hand of the user and including a first set of substantially parallel rows of keys;
 - 10 a second array of keys intended for predominant use by a second hand of the user and including a second set of substantially parallel rows of keys, the rows in the second set of rows of keys being substantially parallel to the rows in the first set of rows of keys when the keyboard is arranged for use by the user; and
 - 15 an interaction area for interaction with the user, the interaction area being located between the first and second arrays of keys when the keyboard is arranged for use by the user and including a display to display information to the user.
2. The keyboard of claim 1, wherein the display is capable of displaying arrays of symbols, the interaction area further including a cursor control device adapted to control a cursor symbol in an array of symbols being displayed on the display.
- 25 3. The keyboard of claim 2, wherein the cursor control device includes at least one cursor control key.
4. The keyboard of claim 1, wherein the interaction area further includes at least one combination key for use in concurrent combination with at least one key in the first or second arrays of keys.
- 30 5. The keyboard of claim 1, wherein the interaction area further includes a third array of keys, the third array of keys being intended for use by either of the first and second hands of the user.
- 35 6. The keyboard of claim 1, wherein the keyboard further comprises first connection means for flexibly connecting the first array to the interaction area and second connection means for flexibly connecting the second array to the interaction

area, so that the first and second arrays can be folded against the interaction area for compact storage.

7. The keyboard of claim 6, wherein the first connection means is a hinge between the first array and the interaction area and second connection means is a hinge between the second array and the interaction area.

8. The keyboard of claim 6, wherein the interaction area has a first side and a second side, the first array being foldable against the first side of the interaction area and the second array being foldable against the second side of the interaction area.

15 9. The keyboard of claim 1, wherein the second array of keys is separated from the first array of keys by a distance that is substantially equal to the width of the body of the user.

10. A method for producing a keyboard for two-handed use by a user, comprising the steps of:

a) producing a first array of keys, the first array of keys being intended for predominant use by a first hand of the user and including a first set of substantially parallel rows of keys;

25 b) producing a second array of keys, the second array of keys being intended for predominant use by a second hand of the user and separated from the first array of keys and including a second set of substantially parallel rows of keys, the rows in the second set of rows of keys being substantially parallel to the rows in the first set of rows of keys when the keyboard is arranged for use by the user;

c) producing an interaction area for interaction with the user, the interaction area including a display to display information to the user; and

35 d) locating the interaction area between the first and second arrays of keys when the keyboard is arranged for use by the user.

11. The method of claim 10, wherein the keyboard includes a

cursor control device for controlling a cursor symbol in a displayed array of symbols and for designating symbols in a displayed array of symbols and step c) includes the step of including the cursor control device in the interaction area.

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12. The method of claim 11, wherein the cursor control device is at least one cursor control key.

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13. The method of claim 10, wherein step c) includes separating the second array of keys from the first array of keys by a distance that is substantially equal to the width of the body of the user.

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14. The method of claim 10, further comprising the steps of:
e) flexibly connecting the first array to the interaction area so that the first array can be folded against the interaction area for compact storage; and
f) flexibly connecting the second array to the interaction area so that the second array can be folded against the interaction area for compact storage.

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15. A keyboard for two-handed use by a user, comprising:
first key array means for operation by a first hand of the user, the first key array means including a first set of substantially parallel rows of keys;
second key array means for operation by a second hand of the user, the second key array means including a second set of substantially parallel rows of keys and being separated from the first key array means, the rows in the second key array means being substantially parallel to the rows in the first key array means when the keyboard is arranged for use by the user; and
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interaction means for interaction with the user, the interaction means being located between the first key array means and the second key array means, the interaction means including display means to display information to the user.

16. The keyboard of claim 15, wherein the display means is capable of displaying arrays of symbols, the interaction means further including cursor control means for controlling a cursor

symbol in an array of symbols being displayed on the display means.

17. The keyboard of claim 15, wherein the cursor control means
5 includes at least one cursor control key.

18. The keyboard of claim 15, wherein the interaction means
further includes at least one combination key for use in
concurrent combination with at least one key in the first or
10 second key array means.

19. The keyboard of claim 15, wherein the keyboard further
comprises first connection means for flexibly connecting the
first array means to the interaction means and second connection
15 means for flexibly connecting the second array means to the
interaction means, so that the first and second array means can
be folded against the interaction means for compact storage.

20. The keyboard of claim 15, wherein the interaction means has
a first side and a second side, the first array means being
foldable against the first side of the interaction means and the
second array means being foldable against the second side of the
interaction means.

FIG. 1
(PRIOR ART)

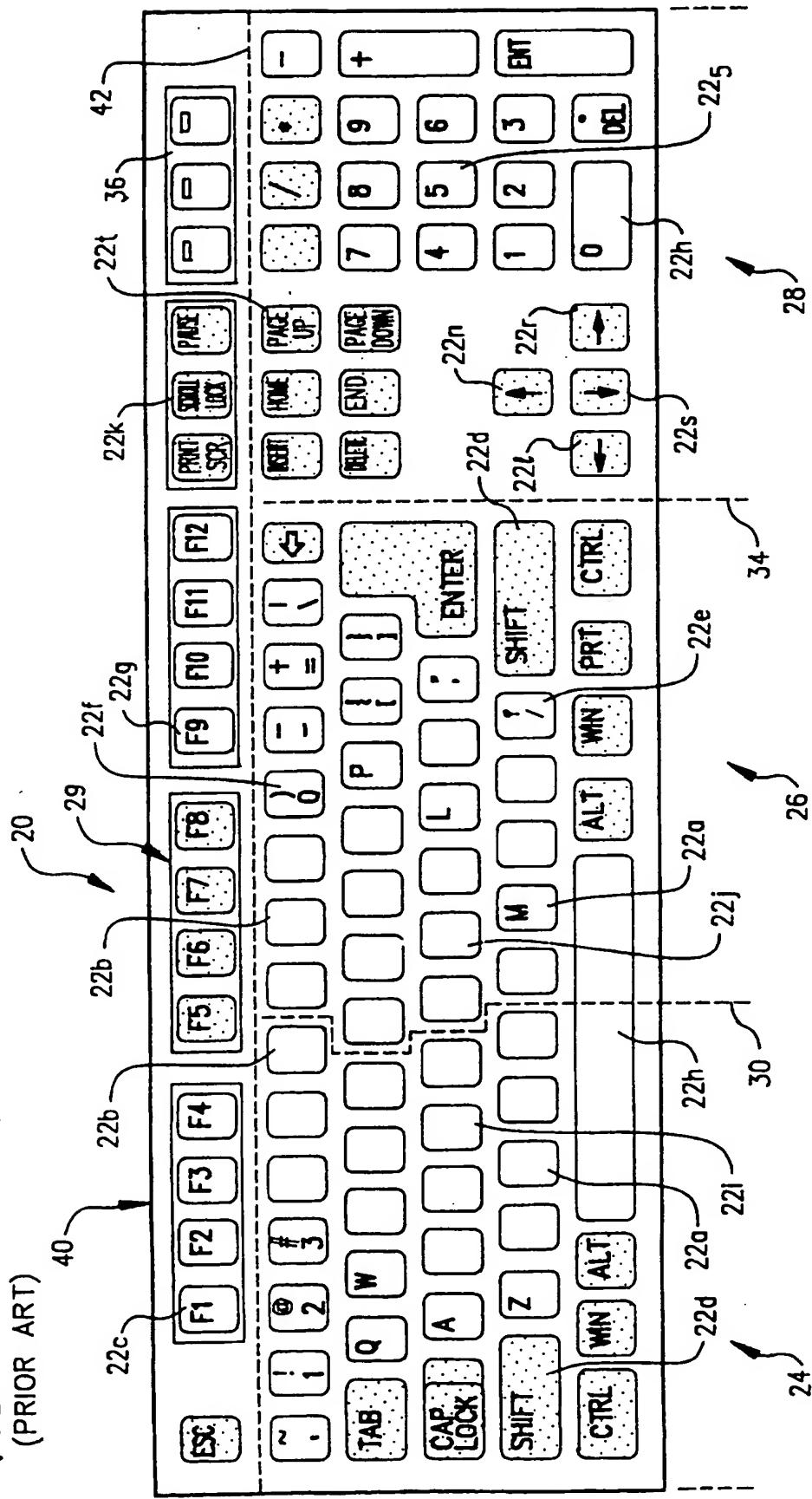
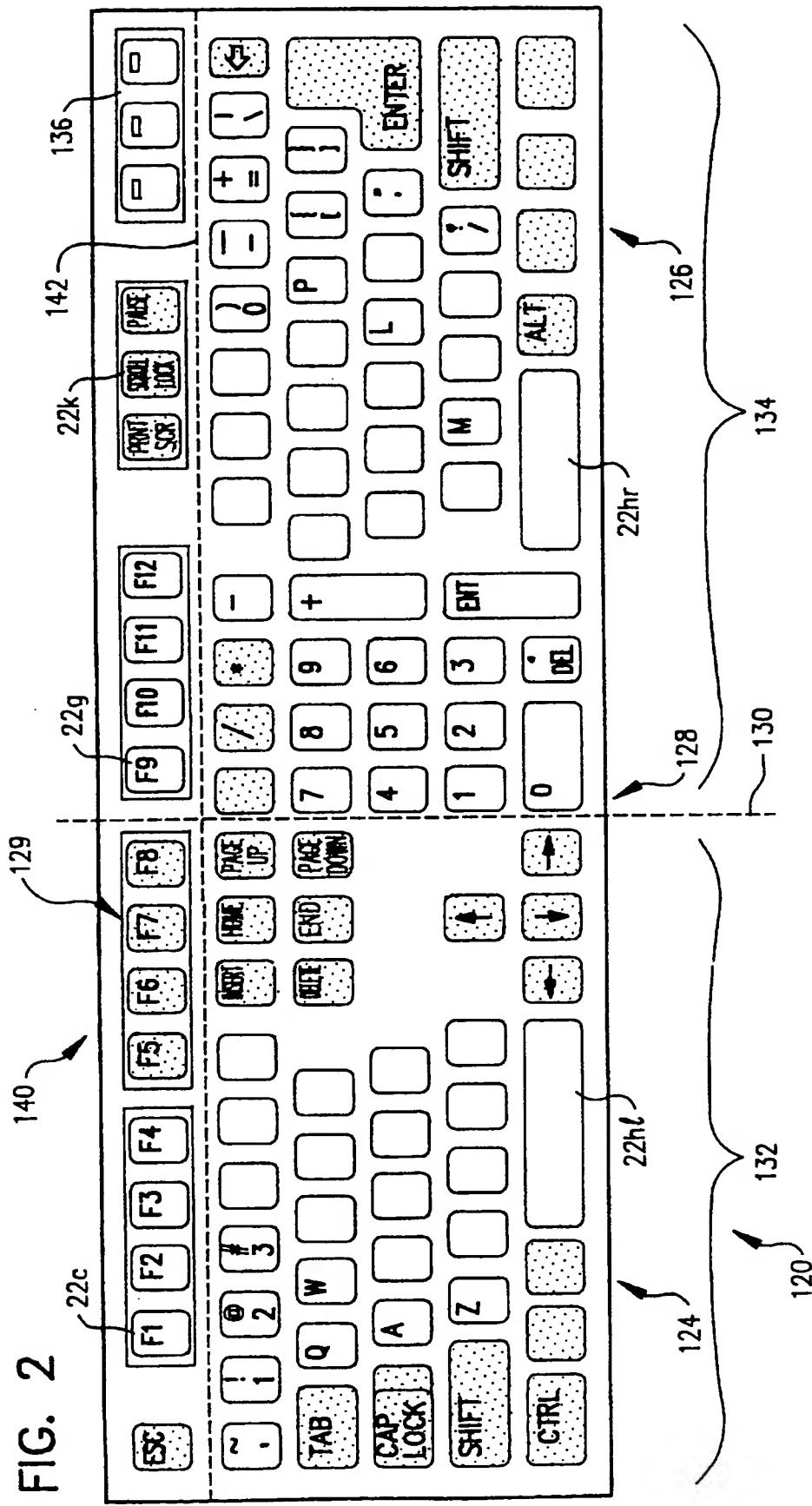


FIG. 2



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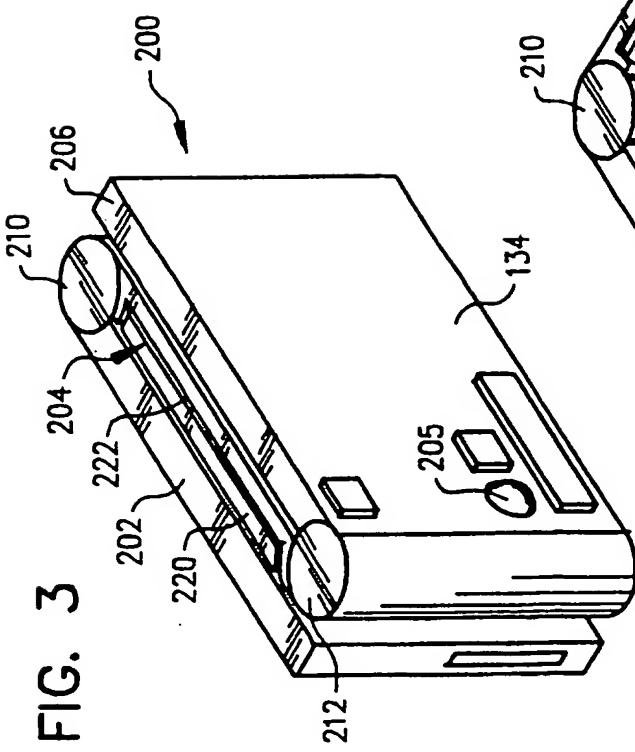
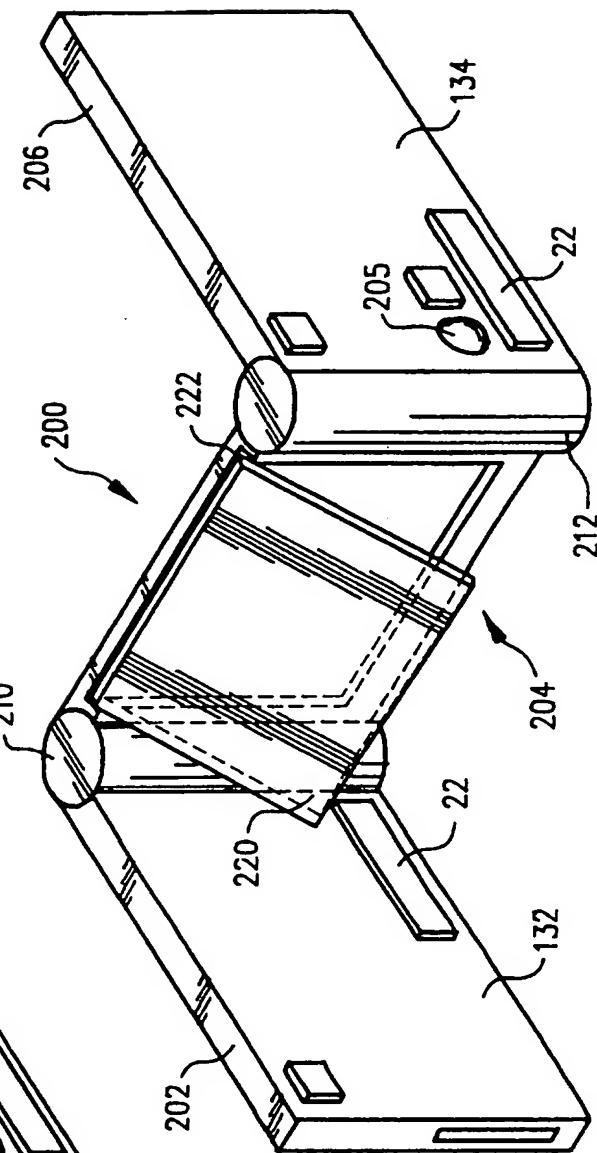


FIG. 4



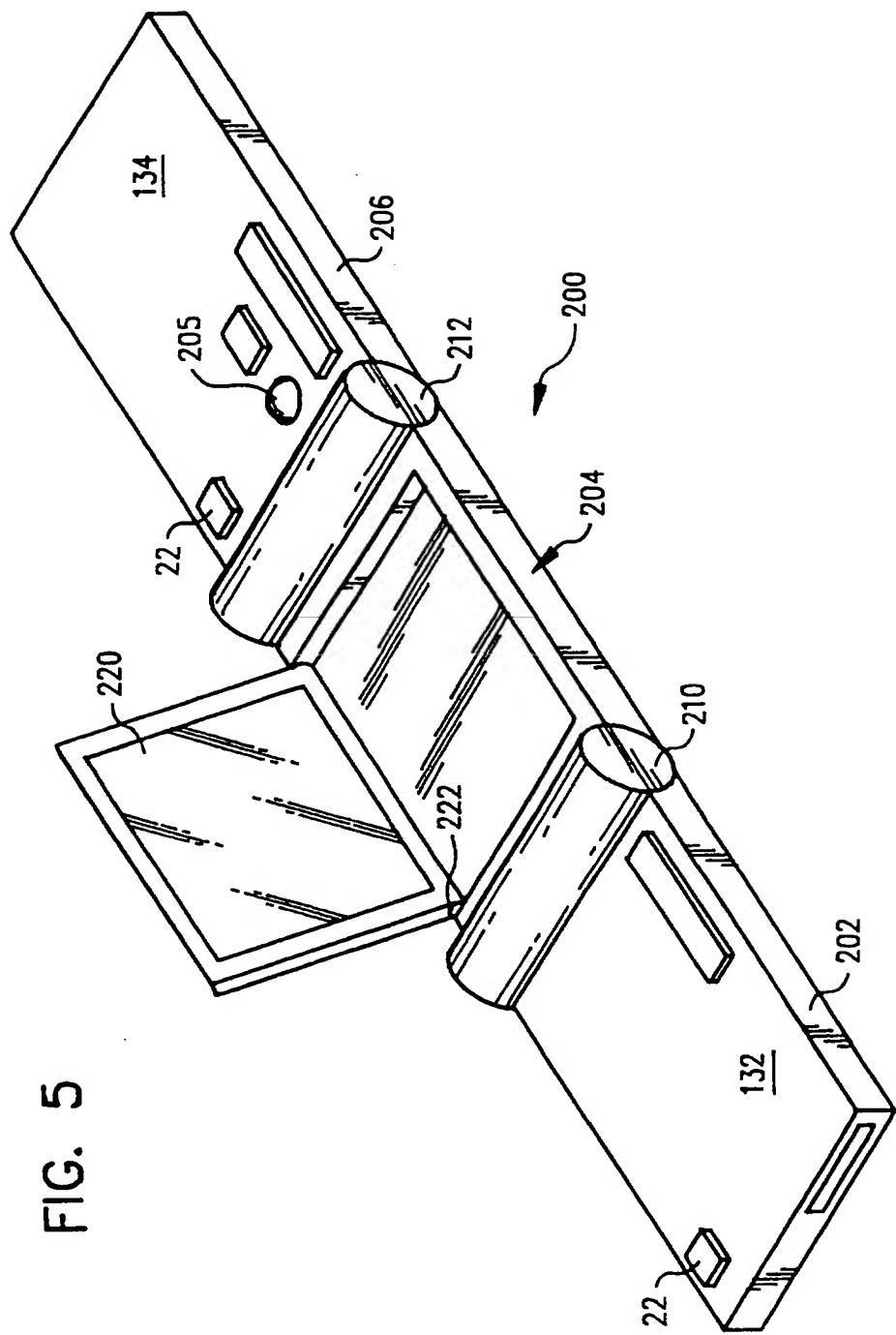


FIG. 5

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FIG. 6

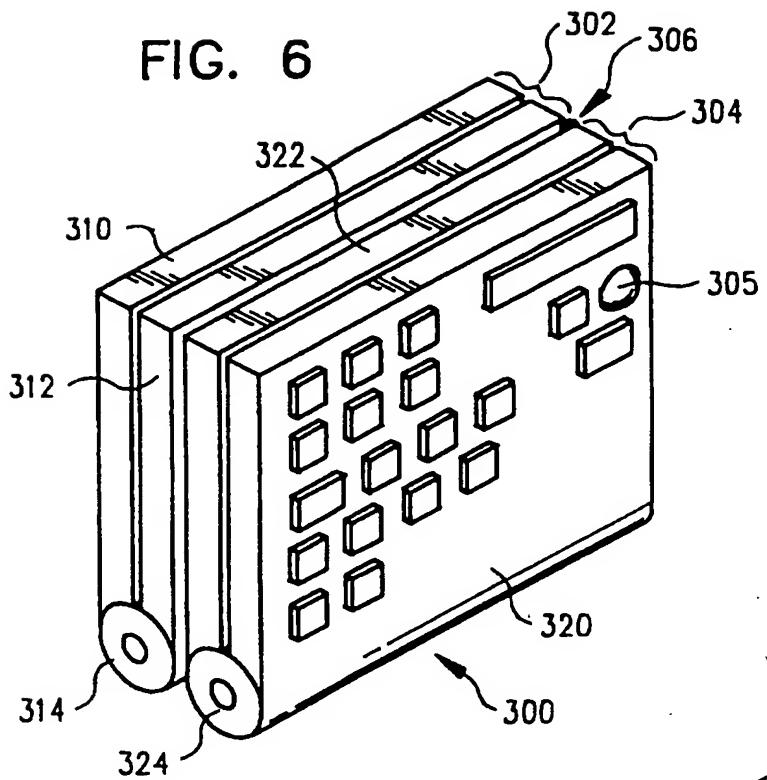


FIG. 7

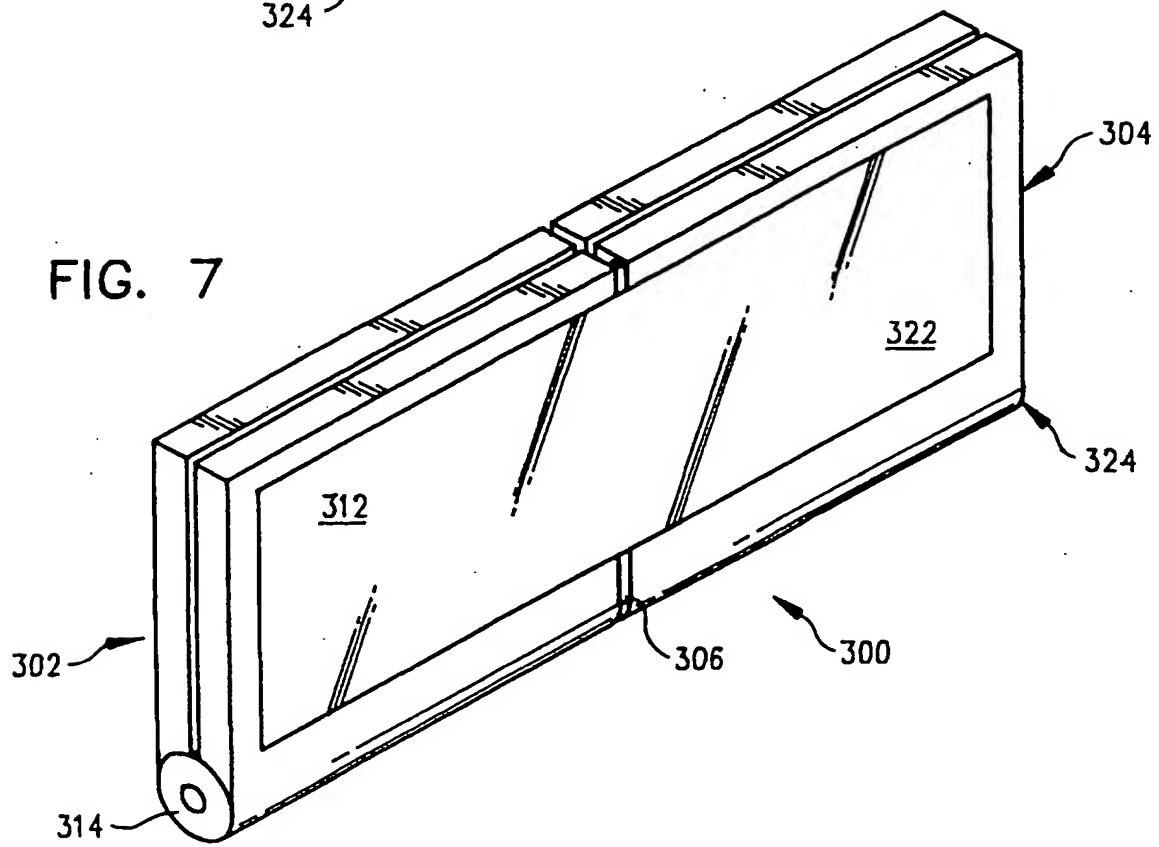
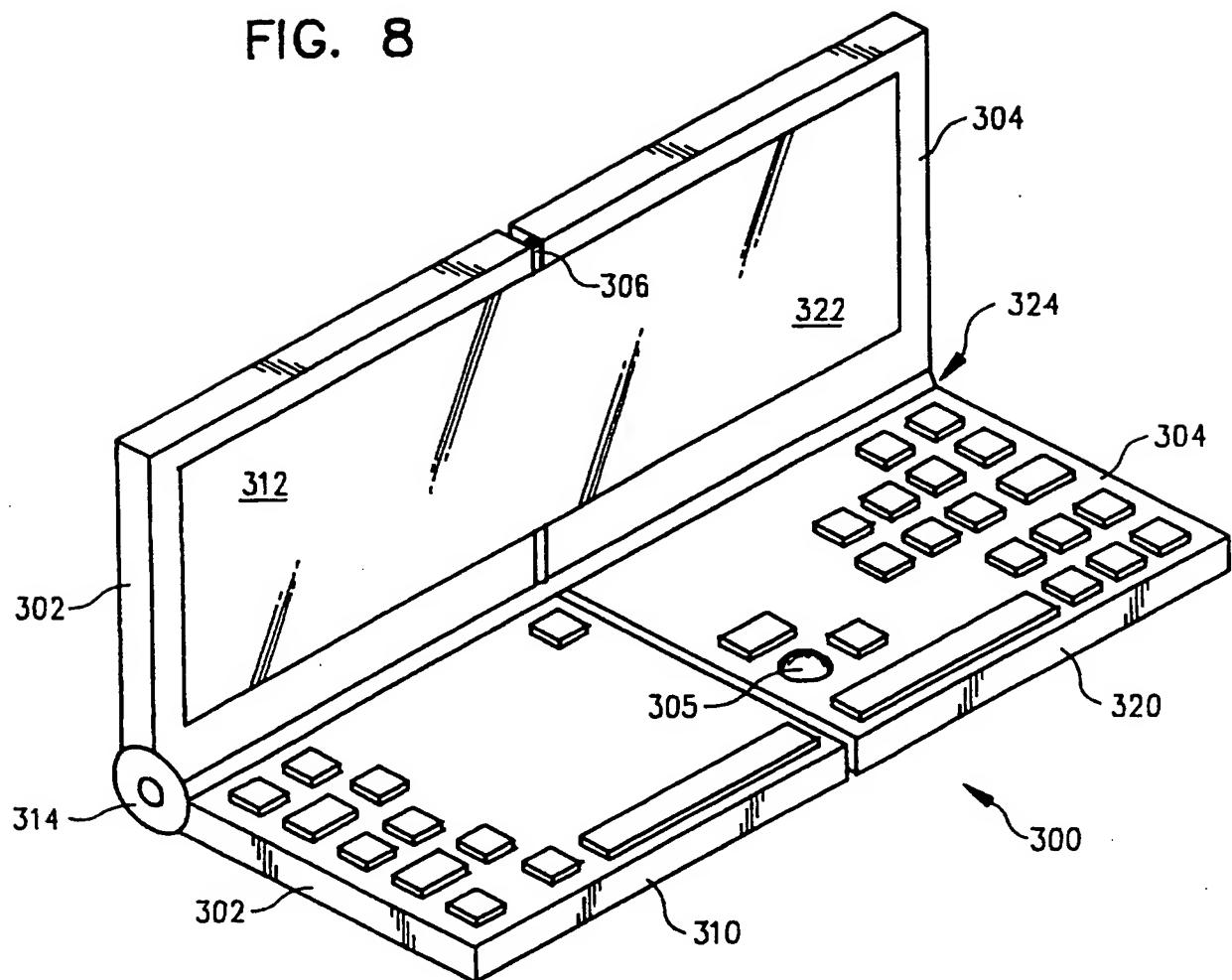


FIG. 8



INTERNATIONAL SEARCH REPORT

International application No.
PCT/US97/11901

A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) :B41J 5/10; G06F 3/02; G09G 5/00; H03K 17/967
US CL :345/168; 361/680; 400/489

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 341/22, 23; 345/168, 169, 172; 361/680; 364/708.1, 709.01, 709.1, 709.12, 709.14, 709.15, 709.16; 400/486, 489

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X ---	US 5,502,460 A (BOWEN) 26 March 1996, col. 2, lines 20-24; col. 7, lines 6-58 and figs. 12-14.	1, 6, 7, 9, 10, 13, 15, 19 -----
Y		2-5, 8, 11, 12, 14, 16-18, 20
Y	US 4,522,518 A (SCHMIDT) 11 June 1985, col. 4, line 55 to col. 5, line 30; col. 10, lines 58-62; col. 11, lines 17-41 and figs. 2-7.	2-5, 8, 11, 12, 14, 16-18, 20

Further documents are listed in the continuation of Box C. See patent family annex.

•	Special categories of cited documents:	
•A	document defining the general state of the art which is not considered to be of particular relevance	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
•B	earlier document published on or after the international filing date	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
•L	document which may throw doubt on priority claim(s) or which is cited to establish the publication date of another citation or other special reasons (as specified)	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
•O	document referring to an oral disclosure, use, exhibition or other means	"Z" document member of the same patent family
•P	document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search	Date of mailing of the international search report
15 SEPTEMBER 1997	21 OCT 1997

Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703) 305-3230	Authorized officer STEVEN J. SARAS Telephone No. (703) 305-4718 <i>John Hill</i>
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